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Technology & Consulting

Solutions using CFD

Many organisations have reaped benefits by using Computational Fluid Dynamics (CFD) software. CFD uses the power of IT to deliver impressive results. However, while a CFD calculation of an aircraft will not design a new aeroplane, design software linked to a CFD package could do so. Smart solutions use technology, particularly IT, to improve the way organisations work so that they can deliver better products at reduced cost and in reduced timescales. Many organisations now recognise that being smart with CFD can lead to even more powerful tools delivering exactly what scientists and engineers need.

What is CFD?

CFD software allows engineers to predict and analyse flows on a computer. The results do not always have the same fidelity as an experiment but can be considerably cheaper and performed in a fraction of the time. In addition, CFD tools can be linked to other design and analysis software, to provide a powerful combined system.

Which CFD system?

There is a huge spectrum of fluid dynamic applications and this is mirrored in the variety of CFD systems available, from general purpose CFD software through to very specific application oriented software. General purpose software is more versatile but specialist software tends to produce results with less user input or at reduced cost or using specific specialist techniques.

There are three sources of CFD software:

1. Commercial Off-the-Shelf Packages

These are publicly available. The user pays a license fee for the software, and may also need to pay for a support license and training.

2. Bespoke Systems

Many organisations, both industrial and academic, develop CFD systems in-house for their own user base. Some bespoke systems are now being offered commercially; others are available on a partnership basis. Users have greater influence over bespoke systems than with commercial systems, and they often contain highly specialised methods that are not available elsewhere.

3. Freeware and Shareware

These range from undergraduate projects to sophisticated systems. Publicly available software is cheap and may allow access to the source code. They usually require some effort in installation and validation before being made fit for the purpose required.

Smart solutions for CFD

Automation

There are three phases involved in getting useful data from a CFD calculation:

1. Turning geometric information into a grid

2. Simulating the flow

3. Analysing and visualising the flow data

These processes can require a lot of user interaction. However, in many organisations where CFD is used routinely, many of these tasks could be automated and performed by software. This software encapsulates the expertise of an experienced user, and bridges these three phases, automatically running the CFD tool on behalf of the engineer.

Specialisation

Many users have their own requirements over and above the functionality provided by a particular CFD tool. This is particularly true for analysis and visualisation.

A number of developments are taking place that will enhance the power of post-processing tools. Several organisations have been developing methods to extract and visualise specific flow features, for example ESPRIT's CLOVIS project. Tessella has been actively involved in this field and as part of this effort has been involved in developing tools to process large datasets efficiently.

CAD

Getting geometries into a form that a CFD package can understand is still a major issue. Many companies find it impossible to seamlessly knit their CAD software with their CFD system using commercial tools. In such cases, specific software is required to provide the bridge. Tessella's experience in customising CAD systems can provide the skills required to perform this task.

Integrated Solutions

Software and IT systems, if designed correctly, can allow designers to benefit from CFD without having to become CFD experts.

A simple example might be to build a GUI for a collection of FORTRAN programs, thus providing an integrated, user-friendly environment coupled with an interactive help system. If designed correctly, such environments can make using CFD software easier and more accessible to CFD non-experts.

At the other extreme, CFD management systems can automate the entire CFD process and other design tools, providing a system which automatically evaluates and redesigns products. Such systems can automatically explore a design space and provide a user-friendly front end to this design space. They can also use databases and other data management facilities to track data through entire projects – much more than a single CFD calculation.

By interweaving high-accuracy/low-cost and low-accuracy/high-cost calculations, CFD management tools can provide a cost effective route to exploring a large number of design concepts.

Building smart systems which manage the use of CFD and other design tools under one interface can lead to a powerful system which radically increases productivity. However, these systems require a wide range of IT and software expertise together with the relevant technical expertise. Tessella is uniquely placed in being able to deliver all of the necessary skills to develop these systems.

Conclusions

CFD is a rapidly developing tool which, together with the correct systems, has the potential to significantly impact and add value to the processes within many organisations. Getting the benefits from this technology may require specialist IT skills. If you are interested in exploring any of the ideas discussed in this article or if you are considering whether a smart IT or software solution could enhance your use of CFD, Tessella could advise you and undertake any development you may need.

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